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**SUPPLEMENTARY TESTS ON THE EFFECTS OF HEATING AND COOLING
A CILIULATE ENVELOPE**

by

Selden D. Cole

Paul R. Achenbach

**Housing and Air Conditioning Section
Building Technology Division**

to
**Office of the Chief of Engineers
Department of the Army
Washington, D. C.**



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SUPPLEMENTARY TESTS ON THE EFFECTS OF HEATING AND COOLING
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1. INTRODUCTION

In response to the request of the Office of The Chief of Engineers, Department of the Army, an investigation was made of the mineral Gilsonite as an insulating material for underground steam pipes operating at a pressure of 125 psig corresponding to a saturation temperature of 350F. The results of that investigation were transmitted to the Office of the Chief of Engineers in a National Bureau of Standards Report No. 4231.

This report summarizes additional information, obtained after the first investigation, as a verification of the effect of cyclic heating and cooling on a Gilsulate envelope.

2. TEST EQUIPMENT

Locte Type B Gilsulate from the same supply of material furnished for the earlier tests was poured around a one inch black iron pipe centered lengthwise in a 9"x9"x2½" box of cement-asbestos board. A copper-constantan thermocouple of no. 24 wire was peened into the pipe about three inches from the outlet end of the box, and a pressure gage was attached to the line downstream from the thermocouple and ahead of a cut-off valve. The other end of the pipe was connected to a source of steam.

INTERVIEW WITH DR. RICHARD J. BROWN, JR., TO STUDY DATA FROM THE
SOUTHERN CALIFORNIA REGION

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The location of light from each of the stars is given in Table I.

Fig. 1. The effect of Na_2EDTA on the Fe^{2+} -catalyzed reduction of H_2O_2 .

the same time as the author and the editor of the book, or
else was distributed by a publisher or bookseller. This
means that it is not possible to identify the author. Instead one
uses the title of the book, the publisher and the date of
publication. The title of the book, the publisher and the date of
publication are often used to identify the author of a given book.
The author's name is usually written on the title page of the book.

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and the following is an outline of the main features of each.

Lebih lanjut dia mengatakan bahwa ada dua faktor yang mempengaruhi keberhasilan pelatihan. Pertama faktor yang mempengaruhi pelatihan adalah faktor internal dan faktor eksternal. Faktor internal meliputi faktor-faktor yang bersifat personal dan faktor-faktor yang bersifat organisasi. Faktor-faktor personal meliputi faktor-faktor yang bersifat individual dan faktor-faktor yang bersifat kelompok. Faktor-faktor organisasi meliputi faktor-faktor yang bersifat teknis dan faktor-faktor yang bersifat sosial-sistemik.

3. PROCEDURE AND RESULTS

Steam at 377°F, as measured with the installed thermocouple, was passed through the pipe embedded in the loose Gilsulate for 4 1/2 hours to provide initial consolidation. At the end of the 4 1/2 hours, an examination of a small section of pipe and insulation at the outlet end showed a very thin consolidated liquid-like layer adhering to the pipe and about one inch thickness of material sintered loosely together. The steam was turned off and the system allowed to cool down normally to room temperature. A series of heating and cooling cycles with steam at a temperature of 350°F followed the initial heating at 377°F, with an occasional inspection of the consolidated core being made near the outlet end of the pipe just before the end of the heating period.

CYCLE	HEATING PERIOD, HR	PERIOD WITHOUT HEAT, HR	INSPECTION
1	5.5	18.5	Yes
2	6.5	17.5	No
3	6.0	18.0	No
4	127.0	41.0	Yes
5	5.0	163	No
6	5.0	19	No
7	7.0	17	No
8	5.5	18.5	No
9	30.0	18.0	No
10	5.5	-	Yes

The inspection following cycle 1 showed a softening of the sintered part of the core to a sponge-like consistency with a thin soft viscous consolidated layer near the pipe.

WILSON'S SPARROW. ♂

smallish bill and white eyebrows on the iris, which
are not produced until about 3 years old; the wings
and tail are blackish with white speculum feathers, the primaries
being blackish with white at base. The bill is very small,
thin & pointed, the nostrils large & well defined, the legs &
feet strong & well developed, the claws being
conical. It breeds in mountainous localities, but will
inhabit any low, thin forest or scrub oak country where
it frequents open glades and fields of low
scrub. The nests are built on bushes and trees, the birds
returning to the same locality year after year.
The nest is a simple cup of twigs and leaves, the
bottom being lined with fine grasses and dried pine needles.

SPECIMEN NO.	WEIGHT IN GRAMS		SEX
	ADULT	YOUNG	
100	2.01	0.72	
101	2.12	2.0	
102	2.05	0.8	
103	2.07	0.70	
104	2.05	0.72	
105	2.1	0.7	
106	2.1	0.7	
107	2.05	0.7	
108	2.07	0.65	
109	2.07	0.7	

The average weight of young birds is about 0.77
grams, while the average weight of adults is 2.05 grams. The
young birds are very pale above, with a few dark feathers
near the wing tips, and the feathers are more rounded than in adults.

The inspection during cycle 4 was in two parts; (1) inspection after 60 hours of heating, showed a harder sintered core, with less viscous material at the pipe and more solid consolidation than before, and (2) at the end of 127 hours inspection showed some viscous material at the bottom of the pipe with none on the top half and an increase in the average size of the sintered core.

The inspection after cycle 10 is illustrated with Fig. 1 and Fig. 2. Fig. 1 shows the sintered core after the removal of the unconsolidated material and reveals a large longitudinal crack on the top. Fig. 2 shows that the sintered material came off the top half in well-defined pieces of coke-like material and with no adhesion to the pipe. The lower half of the core consisted of a sintered outside layer and an inner layer of a stiff gummy consolidated material adhering to the pipe. The adhesion can be seen below the center line of the pipe in Fig. 2.

4. CONCLUSION

Repeated heating and cooling of the Gilsulate conduit for a cumulative heating period of 203 hours showed different results at the top and bottom of the pipe. The top half showed numerous thin cracks that did not heal upon reheating. The inside surface was hard and free from the pipe. The lower half of the core adhered to the pipe after 203 hours of heating with some of the consolidated layer being softened

to a gummy viscous consistency at a pipe temperature of 350°F. The cracking of the envelope and the fracture of the material into coke-like lumps was similar to that reported for the earlier investigations.

The most important finding is the considerable variability present in the individual effect of each factor and its influence on the total yield. The yield effect of each factor is highly variable and fluctuating and cannot be estimated with any degree of certainty.



FIG. 1

✓✓✓✓

FIG. 2



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